Two-Dimensional Planetary Surface Landers

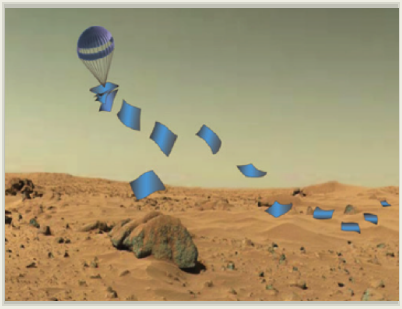
Completed Technology Project (2013 - 2014)

Project Introduction

We propose to develop a new landing approach that significantly reduces development time and obviates the most complicated, most expensive and highest-risk phase of any landing mission. The concept is a blanket- or carpet-like two-dimensional (2D) lander with a low mass/drag ratio, which allows the lander to efficiently shed its approach velocity and provide a more robust structure for landing integrity. The flat nature and low mass of these landers allows dozens to be stacked for transport and distributed en masse to the surface. The concept leverages recent developments in microelectronics and MEMS technology, such as the lab-on-a-chip, integrated RF comm, and laser probes. A stack of individual flexible sheets, each equipped with a variety of planet/body probing sensors, power generators, associated avionics, and telecommunications capability comprise two-dimensional (2D) spacecraft landers.

Anticipated Benefits

We proposed to develop a new landing approach that significantly reduces development time and obviates the most complicated, most expensive, and highest-risk phase of a landing mission. The concept allows the lander to efficiently shed its approach velocity and provide a more robust structure for landing integrity. The mass and size of these highly capable technologies further reduces the required stiffness and mass of the lander structures to the point that compliant, lightweight, robust landers capable of passive landings are possible. This capability avoids the costly, complex use of rockets, radar, and associated structure and control systems. This approach is expected to provide an unprecedented science payload mass to spacecraft mass ratio of approximately 80% (estimated based on current knowledge). This compared to ~1% for Pathfinder, ~17% for MER, and 22% for MSL rovers.



Concept Graphic

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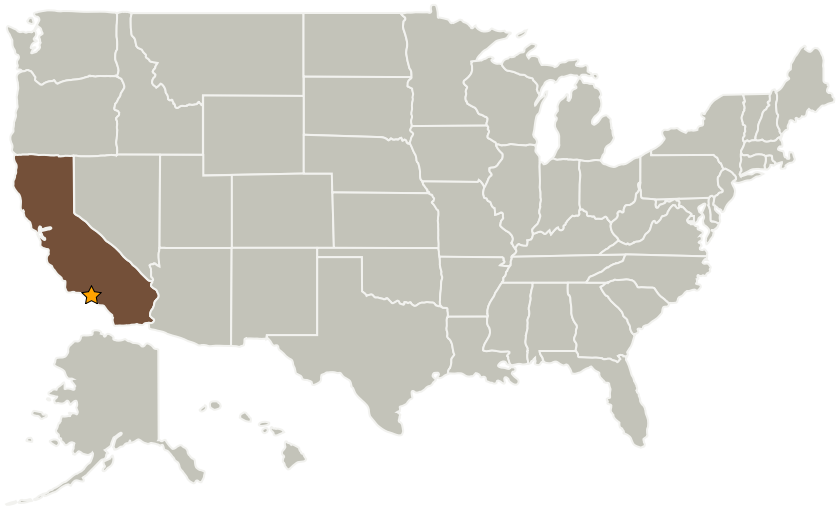
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

September 2013: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

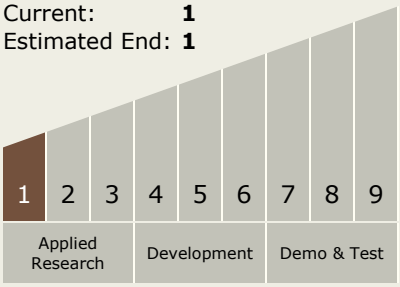
Eric A Eberly

Principal Investigator:

Hamid Hemmati

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



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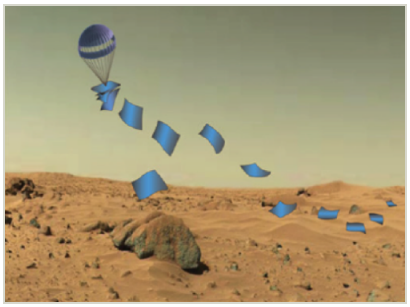
June 2014: Closed out

Closeout Summary: We proposed to develop a new landing approach that sign ificantly reduces development time and obviates the most complicated, most ex pensive, and highest-risk phase of a landing mission. The concept is a blanket- or carpet-like two-dimensional (2D) lander (~1-m × 1-m surface area and <1-c m thick) with a low mass/drag ratio, which allows the lander to efficiently shed i ts approach velocity and provide a more robust structure for landing integrity. T he form factor of these landers allows dozens to be stacked on a single spacecra ft for transport and distributed en masse to the surface. Lander surfaces will be populated on both sides by surface-mount, low-profile sensors and instruments, surface-mount telecom, solar cells, batteries, processors, and memory. Landers will also incorporate thin flexible electronics, made possible in part by printable electronics technology. The mass and size of these highly capable technologies f urther reduces the required stiffness and mass of the lander structures to the po int that compliant, lightweight, robust landers capable of passive landings are po ssible. This capability avoids the costly, complex use of rockets, radar, and asso ciated structure and control systems. This approach is expected to provide an u nprecedented science payload mass to spacecraft mass ratio of approximately 8 0% (estimated based on current knowledge). This compared to ~1% for Pathfin der, ~17% for MER, and 22% for MSL rovers. Clearly, one difference is rovers v s. a lower capability lander. An outcome of the Phase I study is a clear roadmap for near-term demonstration and long-term technology development.

Images



Two-Dimensional Planetary Surface Landers
Concept Graphic
(https://techport.nasa.gov/image/102179)

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.2 Above-Surface Mobility

Target Destinations

Earth, The Moon, Mars